AD-A075 198 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OH F/G 22/2
ARTIFICIAL HEAVENLY PALACES,(U)
JUN 79 S TAIN
UNCLASSIFIED FTD-ID(RS)T-0610-79 NL

1 OF 1
AD A075198

END
DATE FILMED
11-79
DDC

DATA PROCESSING SHEET

PHOTOGRAPH THIS SHEET

1
INVENTORY

AD A075198
DDC ACCESSION NUMBER

FTD-ID(RS)T-0610-79
DOCUMENT IDENTIFICATION

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited
DISTRIBUTION STATEMENT

Accession For
NTIS GRA&I [X]
DDC TAB [ ]
Unannounced
Justification
By
Distribution/
Availability Codes
Dist. | Avail and/or special
A
DISTRIBUTION STAMP

DDC
RECEIVED
OCT 19 1979
E
DATE ACCESSIONED

See document
DATE RECEIVED IN DDC

PHOTOGRAPH THIS SHEET

AND RETURN TO DDC-DDA-2

FTD-ID(RS)T-0610-79

FOREIGN TECHNOLOGY DIVISION

ARTIFICIAL HEAVENLY PALACES

By

Shu Tain

EDITED TRANSLATION

FTD-ID(RS)T-0610-79 11 June 1979

MICROFICHE NR: FTD-79-C-000761

ARTIFICIAL HEAVENLY PALACES

By: Shu Tain

English pages: 10

Source: Hang K'ung Chih Shih, Nr. 12, 1978, pp. 27-29

Country of Origin: China
Translated by: LINGUISTICS SYSTEMS, INC.
F33657-78-D-0618
Fang-Ling Needham
Requester: FTD/TQTR

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

ARTIFICAL HEAVENLY PALACES

Shu Tain

The name "heavenly palace" has a mythological basis in Chinese history. In the famous Chinese movie "Disturbance in the Heavenly Palace" the ideal mythical palace is the result of human beings' hopes and ideals for thousands of years. However, with the rapid development of aerospace technology, human beings now have the power to create a space colony more beautiful than the mythical one.

In recent years people have discussed the possibility of building space colonies for the benefit of mankind and to advance space exploration. These colonies are envisioned as complete with factories, housing facilities, and even farmland, supporting generation after generation of inhabitants in an earth-like environment, and producing corps and products superior to those found on the earth .... This is not only an ideal, but also a challenge to mankind's ability. One cannot help but question whether this ideal can be realized.

Since the nineteen sixties it has been shown that humans can survive in space for up to several months. However, to live indefinitely in space in an earthlike environment it is necessary to have abundant food and water, and an earthlike atmosphere and gravitational field. A reliable and abundant source of energy is also needed. In order to build a space colony of the type contemplated, it would be necessary to ship huge quantities of raw materials and equipment from the earth or other planets. The development of technology over thousands of years and the recent explosive progress in aerospace technology, however, have transformed the idea of a "space colony" from the realm of fantasy to that of a realizable possibility.

As mankind has made his first steps into space in the last decade, a number of proposals for the development of a space colony have been formulated and debated. Among these, the wheel type of colony and a colony consisting of cylindrical twin cities seem to be the most realistic. Let us consider them in turn:

Wheel type "crystal palace"

The simplest and most feasible type of space colony would consist of an immense wheel (see article lead figure and the cover) revolving about a central axis. This type of space colony could support about ten thousand people. The diameter

of this wheel would be 1,790 meters, with people living in the outer rim, 130 meters across. There would be schools, factories, hospitals, stores, and even forest, grasslands, and farms in this outer rim. The outer rim would have to be made of materials, possibly mined on the moon, which would protect the inhabitants from cosmic radiation. Sunlight would enter through expanses of curved glass only meters above the ground; because of this it has been called a "wheel type crystal palace."

The colony would rotate once per minute to create a centrifugal force about equal to earth's gravity. However, no gravity would be felt at the central hub - here products could be manufactured which might be impossible on the earth, using raw materials obtained from other planets. Some necessities, such as plant life and initial food supplies would be imported from the earth. In the hub would be located the space port where materials would enter the colony. Elevators would transport workers from the rim to the hub through spokes in the wheel (see Figure 1). A large lens on top of the "crystal palace" and a series of mirrorlike "venetian blinds" would control sunlight entering the colony but reflect cosmic radiation.

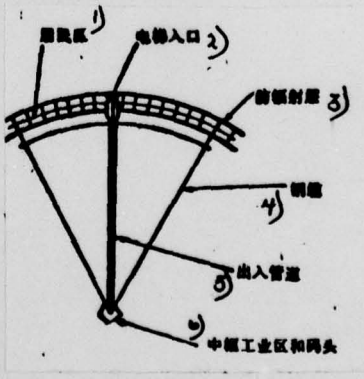

Fig. 1. Section of wheel type space colony.

1) residential area, 2) elevator entrance, 3) radiation prevention layer, 4) cable, 5) tunnel, 6) central industrial area and dock.

Inside the "crystal palace" would be a green, earthlike environment, with birds flying among the trees, cars driving along the roads, residents walking on the sidewalks, and workers hurrying to catch the elevators to the zero gravity factories in the hub. The climate would be forever springlike and the colony full of human activity. The"crystal palace" could not only supply all the necessities for human existence, but also produce rocket fuel, solar power and be used as a port for space ships. The space colony would be a point of departure for further space exploration

To transform this vision into reality is easier said than done. At least forty thousand tons of building materials would be necessary to construct the rim, with the total weight of the colony and its contents about one hundred thousand tons. Although most raw materials could be obtained economically from other planets, some would have to be delivered from the earth. If the development of aerospace technology goes well, the space colony project could begin by 1980, with completion by 1990, provided approximately 1700 tons of building materials can be delivered from the earth.

Cylindrical Twin Cities

The "twin cities" type of colony is more complicated- this colony would consist of two immense linked cylinders, rotating about their common axis at about 1/2 revolution

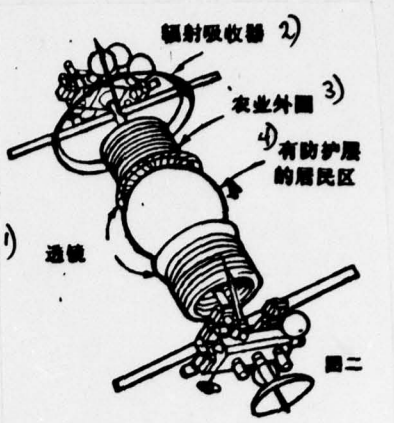

Fig. 2.

1) lens, 2) radiation absorber, 3) agriculture area, 4) residential area with protecting layer.

per minute to simulate terrestrial gravity. Each cylinder would be 32 kilometers long and 6.4 km in diameter. Its environment would be much like the earth's with parks, trees, and artificial lakes. People could commute between the two cylinders through a connecting tunnel, the cylinders being 90 km apart. Like the earth, the cylinders would have seasons - when one cylinder is enjoying summer, the other would be in the middle of winter.

Three long reflecting mirrors would be placed on the periphery of the cylinders, with alternation of day and night and of the seasons being controlled by the reflected sunlight from these mirrors. At the curve-shaped ends of the twin cities would be farms, factories, postal services, and space ports. From 200,000 to 20,000,000 people could inhabit these vast twin cities, which would require several million tons of building

Table 1. Four proposals for twin cities.

	1) 圆柱体长度(公里)	2) 圆柱体直径(公里)	3) 自转周期(秒)	4) 可住人口(万)	5) 最早实现的可能年份
1	1	0.2	21	1	1998
2	3.2	0.64	36	10~20	1996
3	10	2	63	20~200	2002
4	32	6.4	114	20~2000	2006

1) Cylindrical length (km), 2) Cylindrical diameter (km), 3) Rotation period (sec), 4) Capacity (1000), 5) Earliest completion date.

material - No doubt colonies of this magnitude could not be built until the twenty first century. A number of suggested size and capacities for this type of colony are listed in Table I.

Among less considered proposals, which can be seen in the accompanying pictures, are spherical types of colonies and a flower shaped "sunflower" colony. The rotating spherical colony (see figure 2) would have a diameter of 1.6 kilometers and could support 10,000 people. A solar energy station, factories and space port are located at two terminals at the outer portion of the sphere. The "sunflower" colony (see picture), with its petal - shaped reflecting mirrors facing the sun and supplying solar energy, would have an inner residential area and outer agricultural area.

Mining and transporting space colony building material

It has been mentioned that a tremendous amount of materials are needed to build any space colony - even the simplest twin city colony (Table I) would require 500,000 tons of building materials, including aluminum, glass, water, tools, electrical supplies, soil, and food (see Table II). Since it would be extremely costly to deliver all of this from the earth, the success of a space colony project would

Table II. Estimated raw materials needed for the prototype twin city colonies

Materials	Required quantity (tons)	Supplied from the earth (tons)
Aluminum (construction mat)	20,000	0
Glass (reflecting sunlight)	10,000	0
Water	50,000	0
Electrical material	1,000	1,000
Special facility, machinery, tools, etc.	1,800	1,800
Soil, Rocks, etc. (basic material)	420,000	0
Liquid hydrogen	5,400	5,400
workers and their belongings (2,000)	200	200
Food	600	600
TOTAL	500,000	10,000

depend on whether materials could be obtained from the moon and other small extraterrestrial objects.

From the moon landings, it is known that moon rocks are rich in aluminum, titanium, and silicon. These elements can form the basis for a space colony. The small gravitational field on the moon means that the cost of transport of materials is reduced - the moon rocks would be refined to metals in space. It is felt that 98% of the required building materials for a space colony could be supplied by the moon with 150 workers, about 100,000 tons of rock could be mined each month. The

workers could be housed temporarily in fuel storage tanks from the space ship, ten to fifteen workers per tank. There would probably be no need for a permanent residence for this temporary operation. To transport this material from the moon, a magnetic float system currently being designed could be used. This system consists of seven ty five to three hundred small magnetic float supporting racks, each rack holding about 9 kilograms of rocks and minerals. These racks can be accelerated in a magnetic field and released when they reach the moon's escape velocity (2.4 kilometers/second), ejecting the material into space. The rocks can be gathered by stations in space, and racks returned by decelerating through another magnetic field. The next reloading cycle will take place in 0.6 seconds (see figure 3). This type of ejecting facility is thought to be quite feasible, although some differences in design exist. The ideal facility would eject about 600,000 tons of moon rocks each year.

The majority of building materials for a space colony could be obtained from a hole 200 meters wide and 200 meters long. The picture illustrates the rock mining and three sets of magnetic ejection zones. Figure 4 illustrates the space colony building process.

Besides obtaining and transporting raw materials to the space colony site, there are many other problems - for

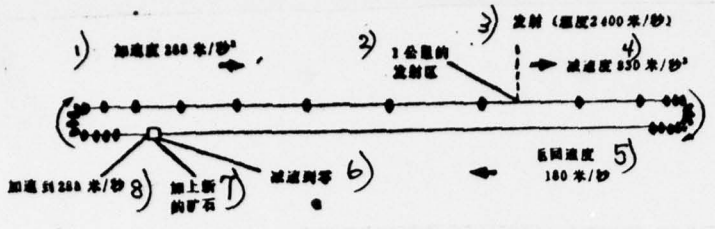

Fig. 3 The principle of the ejection zone on the moon
1) acceleration 288 m/sec^2, 2) 1 km ejection area, 3) ejection (speed 2400 m/sec), 4) acceleration 830 m/sec^2, 5) return speed 180 m/sec., 6) reducing speed to zero, 7) reloading new rocks, 8) accelerate to 288 m/sec

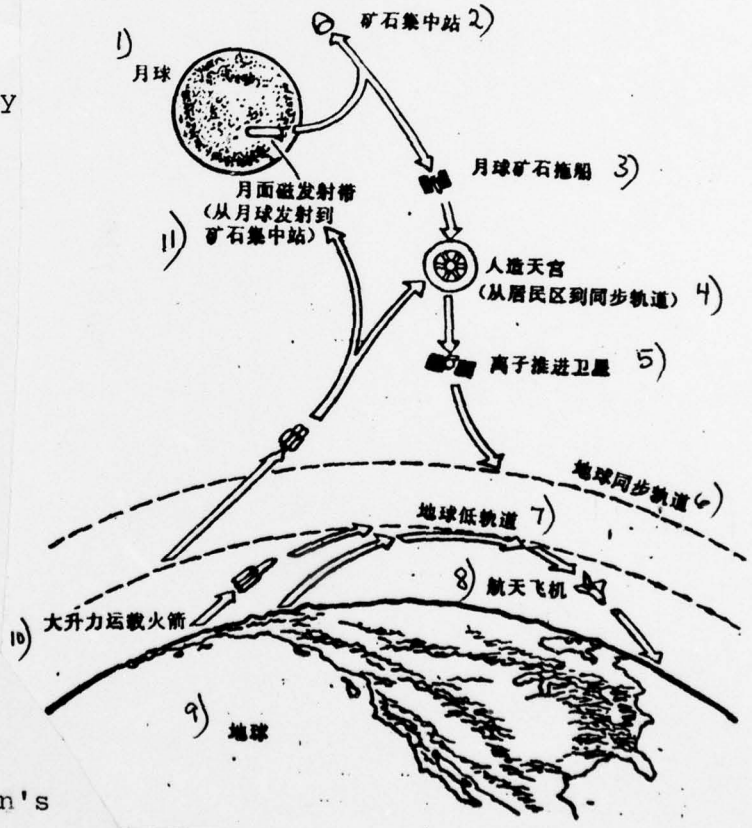

Fig. 4 The construction of space colony
1) moon, 2) rock gathering station, 3) space transport ship 4) space colony (from residential area to the synchronous orbit), 5) satellite, 6) orbit synchronous with the earth, 7) lower orbit, 8) air plane, 9) earth, 10) rocket, 11) magnetic ejection zone on the moon's surface (ejecting from the moon to the rock gathering station)

example, how to smelt and refine the moon ores in space, how to construct the colony in space, life support and radiation protection for workers at the construction site. Even with the successful construction of a space colony, there could be unforeseen biological and sociological problems. In summary, the many proposals for a space colony have undergone change, debate, and modification over the years, and are currently approaching the stage of real possibility.

Article lead figure: Cha Lee

Figures: Cha Lee, Shu Han Wen